Physics 600 Spring 2019
X-ray and Neutron Diffraction

Course Information:	
Course	PHYS 600 - 001
RN	25757
Title	X-RAY AND NEUTRON DIFFRACTION
	10:50AM - 12:05PM TR KWG 128 Keith-Wiess Geological Laboratories.....23
Instructor(s)	Huang, Huey W.
Duration	07-JAN-19 to 19-APR-19

This is an introductory course on X-ray and Neutron Diffraction for beginners, with exercises to learn the use of the techniques. Primary focus will be on X-ray diffraction and scattering techniques. The difference between neutron and X-ray will be explained. Neutron has very important applications to the study of magnetism, but this belongs to a specialty that will not be included.

Content includes: **1. Photon scattering by an electron:** Derivation of Kramers-Heisenberg formula; Polarization factor. **2. X-ray scattering:** Scattering by atoms and by diatomic molecules; Scattering by a sphere; Concept of correlation function. Meaning of ensemble average. **3. Small angle scattering:** Conditions for SAXS: small Q, no multiple scattering, requirement for the background, Irrespective of the shape, small Q region measures the radius of gyration. Shape determination in intermediate Q.

$1/Q^4$ as $Q \rightarrow \infty$. Problems of SAXS: particles too large, crystalline samples. **4. Correlation functions—Scattering by a liquid:** Zernicke-Prins equation for the structure of liquid. **5. Crystals:** Lattice and reciprocal lattice. Bragg law, Laue equations. 7 crystal systems, 14 Bravais lattices, 32 point groups, 230 space groups. **6. Integrated intensity:** Single crystal diffraction. Powder diffraction. Diffraction from partially oriented samples. Debye-Waller temperature factor. Correction factors. Reconstruction of electron density map. **7. Non-gaussian diffraction:** Caille's theory. **8. Neutron diffraction:** Magnetic diffraction. **9. Inelastic scattering:** Neutron. X-ray.